

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a reference value determined depending upon a required flatness required to the glass substrate by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity, the local machining being carried out by plasma etching or a gas cluster ion beam; and

a polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining; wherein:

the surface of the glass substrate subjected to the local machining is subjected to acid treatment in an acid treatment step after the flatness control step and before the polishing step, said acid treatment step thereby removing machining scraps of the glass substrate, a reaction product, and a machining-affected layer produced by the local machining by the plasma etching or the gas cluster ion beam and left on the surface of the glass substrate;

said method producing, as said glass substrate, a glass substrate for an EUV (extreme ultra violet) mask blank and comprising said flatness control step, said acid treatment step, and said polishing step carried out in this order to thereby make the surface of the glass substrate have a flatness and a surface roughness required to the glass substrate for the EUV mask blank .

2. (currently amended): A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a reference value determined depending upon a required flatness required to the glass substrate by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity, the local machining being carried out by plasma etching or a gas cluster ion beam; and

a polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining; wherein:

the surface of the glass substrate subjected to the local machining is subjected to alkali treatment in an alkali treatment step after the flatness control step and before the polishing step, said alkali treatment step thereby removing machining scraps of the glass substrate, a reaction product, and a machining-affected layer produced by the local machining by the plasma etching or the gas cluster ion beam and left on the surface of the glass substrate;

said method producing, as said glass substrate, a glass substrate for an EUV (extreme ultra violet) mask blank and comprising said flatness control step, said alkali treatment step, and said polishing step carried out in this order to thereby make the surface of the glass substrate have a flatness and a surface roughness required to the glass substrate for the EUV mask blank.

3. (canceled).

4. (previously presented): A method according to claim 1, wherein an acid used in the acid treatment is fluorosilic acid and/or hydrofluoric acid.

5. (original) A method according to claim 1, wherein an acid used in the acid treatment is sulfuric acid.

6. (original) A method according to claim 1, wherein the surface of the glass substrate subjected to the acid treatment is subjected to alkali treatment after the acid treatment.

7. (currently amended): A method according to claim 1, wherein the reference value is not greater than ~~0.25~~ 0.5 μm .

8. (original) A method of producing a mask blank, the method comprising the steps of preparing the glass substrate obtained by the method according to any one of claims 1 to 7, and forming a thin film as a transferred pattern on the glass substrate.

9. (original) A method of producing a transfer mask, the method comprising the steps of preparing the mask blank obtained by the method according to claim 8 and patterning the thin film of the mask blank to form a thin film pattern on the glass substrate.

10. (original) A method of producing a semiconductor device, the method comprising the steps of preparing the transfer mask obtained by the method according to claim 9 and transferring the thin film pattern of the transfer mask onto a semiconductor substrate by lithography.

11. (canceled).

12. (currently amended): A method according to claim 2, wherein the reference value is not greater than ~~0.25~~ 0.5 μm .

13. (previously presented): A method of producing a mask blank, the method comprising the steps of preparing the glass substrate obtained by the method according to any one of claims 11 and 12, and forming a thin film as a transferred pattern on the glass substrate.

14. (previously presented): A method of producing a transfer mask, the method comprising the steps of preparing the mask blank obtained by the method according to claim 13 and patterning the thin film of the mask blank to form a thin film pattern on the glass substrate.

15. (previously presented): A method of producing a semiconductor device, the method comprising the steps of preparing the transfer mask obtained by the method according to claim 14 and transferring the thin film pattern of the transfer mask onto a semiconductor substrate by lithography.

16. (previously presented): A method according to claim 1, wherein said flatness control step, said acid treatment step, and said polishing step are carried out in this order to thereby make the surface of the glass substrate have a surface roughness Ra of 0.2 nm or less, where the surface roughness Ra is representative of a center-line-mean roughness.

17. (currently amended): A method according to claim 2, wherein said flatness control step, said alkali treatment step, and said polishing step are carried out in this order to thereby make the surface of the glass substrate have a surface roughness Ra of 0.2 nm or less, where the surface roughness Ra is representative of a center-line-mean roughness. (new)

18. (previously presented): A method according to claim 1, wherein said glass substrate makes use of a SiO₂-TiO₂ glass.

19. (previously presented): A method according to claim 18, wherein concentration of acid used in the acid treatment is 0.05-10 vol%.

20. (previously presented): A method according to claim 2, wherein said glass substrate makes use of a SiO₂-TiO₂ glass.

21. (previously presented): A method according to claim 20, wherein concentration of alkali used in the alkali treatment is 0.5-10 vol%.

22. (currently amended): A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a reference value determined depending upon a required flatness required to the glass substrate by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity, the local machining being carried out by plasma etching or a gas cluster ion beam; and

a polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining; wherein:

the surface of the glass substrate subjected to the local machining is subjected to one of an acid and alkali treatment in an acid or alkali treatment step, respectively, after the flatness control step and before the polishing step, said acid or alkali treatment step ~~being carried out thereby removing machining scraps of the glass substrate, a reaction product, and a machining-~~

affected layer produced by the local machining by the plasma etching or the glass cluster ion beam and left on the surface of the glass substrate while maintaining a flatness of the surface of the glass substrate and without deteriorating a surface roughness of the surface of the glass substrate;

said method producing, as said glass substrate, a glass substrate for an EUV (extreme ultra violet) mask blank and comprising said flatness control step, said acid or alkali treatment step, and said polishing step carried out in this order to thereby make the surface of the glass substrate have a flatness and a surface roughness required to the glass substrate for the EUV mask blank.

23. (previously presented): A method according to claim 22, wherein concentration of acid used in the acid treatment is 0.05-10 vol%.

24. (previously presented): A method according to claim 22, wherein concentration of alkali used in the alkali treatment is 0.5-10 vol%.